SHORELINE CHANGES IN THE CAMINADA-MOREAU HEADLAND AND GRAND ISLE - 1887 TO 1996 LAFOURCHE AND JEFFERSON PARISHES, LOUISIANA

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INTRODUCTION

The U.S. Geological Survey (USGS), in cooperation with the Coastal Research Laboratory in the Department of Geology and Geophysics at the University of New Orleans (UNO) and the Center for Coastal Energy and Environmental Resources at Louisiana State University (LSU), is investigating the processes of coastal erosion in Louisiana (Sallenger and others, 1987; Sallenger and Williams 1989; Penland and others, 1992). Building on the USGS Louisiana Barrier Island Study (Williams and others, 1992), this USGS Open-File Report depicts shoreline changes between 1887 and 1996, which provides an 8.9-year update of McBride and others (1992). In order to quantify shoreline changes since January 21, 1988, new vertical aerial mapping photography was acquired on December 9, 1996. The methods and transects used by McBride and others (1992) were used to insure data compatibility of the new measurements and analysis (Plate 7). Tables 1 and 2 present the transect measurements of shoreline change for the Caminada-Moreau Headland and Grand Isle. For gulfside change measurements, a negative (-)sign signifies landward movement or erosion and a positive (+) sign signifies a seaward movement or progradation. For bayside change measurements, a negative (-) sign signifies a seaward movement or erosion and a positive (+) sign signifies a landward movement or accretion.

The Caminada-Moreau Headland and Grand Isle are located approximately 90km south of New Orleans (Figure 1) and is bordered by Raccoon Pass in the west and Barataria Pass in the east. Since 1887 the Caminada-Moreau Headland has experienced some of the highest rates of shoreline movement along the Louisiana coastline. Conversely, Grand Isle, east of Caminada-Moreau and separated by the Caminada Pass, has experienced stationary or accretionary rates of shoreline movement over most of its coastal shoreline.

The Caminada-Moreau Headland primarily consists of cohesive deltaic sediment and a large, sandy beach ridge plain with no back-barrier lagoon or bay. Bell Pass, Pass Fouchon, and Bayou Moreau separate the central headland area. With the exception of Bayou Moreau, Bell Pass and Pass Fouchon have seen extensive man-made influences in the form of canal widening and dredging. By 1956, the Bell Pass Jetties had begun to interrupt the large quantities of erosional downdrift sediment from the central headland area causing the magnitude of downdrift offset to increase west of Bell Pass. As a result of this highly erosional shoreline, Bayou Moreau now intersects the shoreline in three different locations. The interior marsh of the Caminada-Moreau Headland is also

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experiencing high rates of loss primarily as a result of numerous dredge canals and levees.

To the east of Caminada Pass lies one of Louisiana's most unique barrier islands. Grand Isle is one of the few barrier islands, which has sustained an accretionary growth since the early 20th century. Because of this morphological stability, it is the only barrier island in Louisiana commercially and residentially developed (Meyer-Arendt, 1987). For 101 years, the gulf shoreline has experienced retreat along its western end while remaining relatively stationary at its midsections and accreting seaward on its eastern end. These trends show that Grand Isle is slowly rotating clockwise around a stable midpoint (McBride and others, 1992). The accretion on the eastern end of Grand Isle can be attributed to Louisiana's deepest tidal inlet (> 40m in 1989) bordering its eastern end, known as Barataria Pass. The Barataria Pass tidal inlet system is a large sediment sink storing most of its sand as a large ebb-tidal delta. Shoreline advance at the eastern end of Grand Isle is directly related to this ebb-tidal delta (Shamban, 1982).

SHORELINE MOVEMENT

Magnitude and rate of change for the Caminada-Moreau Headland and Grand Isle were derived from 91 shore-normal transects along the gulf and bay shorelines (Transects Map, Tables 1&2). Comparisons of shoreline positions are made for the periods 1887 vs. 1988, 1988 vs. 1996, and 1887 vs. 1996. The overlay maps illustrate land loss and quantitative changes for the Caminada-Moreau Headland and Grand Isle. Because of the unique nature of this region, this study divided the above mentioned barrier system into two sections: Caminada-Moreau Headland, between Raccoon Pass in the west and Caminada Pass in the east, and Grand Isle, between Caminada Pass in the west and Barataria Pass in the east.

GULFSIDE SHORELINE CHANGES

In terms of the long-term gulfside shoreline change history for the 109 year period between 1887 and 1996, the Caminada-Moreau Headland shoreline transects measured between –150m and –2068m (Table 1, 1887-1996, transects 1-38). The average shoreline change was determined to be 1373.7m, which yields an average yearly rate of –12.6m/yr (Table 3). During the same period, Grand Isle's gulfside transects measured between 674m and –262m (Table 1, 1887-1996, transects 39-62) resulting in an average shoreline change of 128.8m. This positive, or gulfward shoreline change measurement reveals a long-term yearly accretion rate of 1.2m/yr (Table 3), which predominately occurs along the eastern two thirds of Grand Isle's gulf shoreline.

For the short-term shoreline change analysis of the 8.9-year period between 1988 and 1996, the Caminada-Moreau Headland gulfside transects ranged from 148m to –100m (Table 1, 1988-1996, transects 1-38) for an average shoreline change of –28.4m or –3.2 m/yr (Table 3). The short-term yearly rate of –3.2m/yr. could be as much as 4.0m/yr. if it were not for the influence of highly variable spit movement at the west end of the Caminada-Moreau Headland (Caminada spit). In terms of the short-term shoreline change history, Grand Isle's gulfside transects were measured from 149m to –69m (Table 1, 1988-1996, transects 39-62) resulting in an average shoreline movement of 36.8m or 4.1m/yr (Table 3).

Previous work by McBride and others (1992) documents long-term shoreline change between years 1887 and 1988 (101 years) and short-term shoreline change between 1978 and 1988 (10 years). For the Caminada-Moreau Headland, the earlier analysis reported a long-term gulf shoreline movement rate of 13.3m/yr (Table 3) and an average short-term shoreline movement rate of 13.6m/yr (Table 3). The Grand Isle gulf shoreline experienced an average long-term advance of 0.9m/yr (Table 3) and a short-term gulfward movement of 5.2m/yr (Table 3).

The comparison between the new long-term shoreline change rate and the McBride and others (1992) long-term change rate shows only a slight difference. The long-term gulf shoreline rate changed from – 133m/yr (1887-1988) to –12.6m/yr (1887-1996) (Table 3), for the Caminada-Moreau Headland, indicating a reduction in erosion by 0.7m/yr. In both studies Grand Isle's rate of long-term shoreline movement has remained nearly the same. The long-term shoreline movement increased toward the Gulf of Mexico by 0.3m/yr, from 0.9m/yr. (1887-1988) to 1.2m/yr. (1887-1996) (Table 3). The Caminada- Moreau Headland experienced a dramatic shift in short-term gulfside erosion rates between the McBride and others (1992) study and this update. For the years between 1978 and 1988, the Caminada-Moreau Headland experienced a guflside rate of change of –13.6m/yr (Table 3). Compared to this study, which reported a short-term gulfside change rate of –3.2m/yr. (Table 3), a reduction of shoreline erosion by 10.4m/yr. was observed.

BAYSIDE SHORELINE CHANGES

The Caminada-Moreau Headland consists predominately of cohesive deltaic sediment and a large, sandy beach ridge plain with no back barrier lagoon or bay. Therefore, the bay shoreline change measurements pertain only to the Caminada spit located at the eastern end of the Caminada-Moreau Headland.

In terms of the long-term bay shoreline change history for the 109-year period between 1887 and 1996, the Caminada spit shoreline transects measured between 203m and 594m (Table 2, 1887-1996, transects 33- 38). The average change was determined to be 394m or 3.6m/yr (Table 3). Grand Isle experienced long-term bay shoreline movement between 326m and –333m (Table 2, 1887-1996, transects 39-62) yielding an average measurement of –108.1m or –1.0m/yr (Table 4).

For the 8.9-year period between 1988 and 1996, Caminada spit underwent very little change in its short-term bay shoreline movement. The Caminada spit bayside movement ranged from 12m to –11m (Table 2, 1988-1996, transects 33-38) for an average of 2.6m at a rate of 0.0m/yr (Table 4). Grand Isle also saw modest movement of its bay shoreline between the years 1988 and 1996. Bayside movement ranged from –47m to 42m, providing an average of –3.6m or –0.6m/yr (Table 4).

McBride and others (1992) studied long-term change rates between years 1884 and 1988 (104 years) and short-term change rates between years 1978 and 1988 (10 years). In this earlier study, long-term bay shoreline change rates for Caminada spit were calculated as 4.1m/yr (Table 4), and short-term shoreline changes were –1.8m/yr. Grand Isle's long-term and short-term bayside shoreline change rates were determined to be –1.0m/yr. and –3.2m/yr. respectively (Table 4).

Drawing on comparisons between the bay shoreline movement rate of the McBride and others (1992) analysis and this study, long-term change rates have remained virtually unchanged. McBride and others (1992) reported a long-term change rate of Caminada spit as 4.1m/yr. (Table 4). This recent study calculated a rate of 3.6m/yr (Table 4), indicating a 0.5m/yr. reduction in landward migration. Grand Isle's long-term bay shoreline change rate was identical in both the McBride and others (1992) and this study, at –1.0m/yr (Table 4).

The short-term bay movement rates revealed slightly more variability between this study and the previous one. McBride and others (1992) observed Caminada spit to have a change rate of –1.8m/yr (Table 4). The short-term rate in this new study is 0.0m/yr (Table 4) indicating the bay shoreline of Caminada spit is entering a period of stability or possible landward migration.

Similar to Caminada spit, the bay shoreline of Grand Isle is also entering a period of transition. Based on the comparison between the short-term movement rates of 3.2m/yr (McBride and others, 1992) (Table 4) and –0.6m/yr (Table 4) calculated in the new study, one could observe an erosional shift of 3.8m/yr. on the bay shoreline of Grand Isle.

AREA CHANGES

Between 1887 and 1996, the total area of Grand Isle has decreased by 170 acres. What is not seen in this long-term comparison is since 1956 the area of Grand Isle has steadily increased. Based on this study's new short-term (1988-1996) area rate calculations, Grand Isle could achieve its 1887 area in a little over sixteen years.

Between 1887 and 1996, Grand Isle's area decreased from 2617 acres to 2447 acres (Table 5). This represents a 6% loss of island area at a rate of –1.6 acres/yr (Table 6). This long-term rate of loss, acting on Grand Isle's area in 1996, forecasts a disappearance date of 3525 (Table 6). Previously, in McBride and others (1992), Grand Isle decreased in area at a rate of 2.4 acres/yr. between 1887 and 1988 suggesting a long-term disappearance date of 2968 (Table 6). This seemingly small rate decrease in area loss will extend the life of Grand Isle by 557 years. For the short-term area analysis, between the years 1988 and 1996, Grand Isle's area increased from 2372 acres to 2447 acres (Table 5). This indicates a 3% gain at a rate of +8.4 acres/yr (Table 6). McBride and others (1992) reported a 3% gain in island area between the years 1978 and 1988, indicating a net short-term gain of 5.9 acres/yr. Comparing the two studies, the recently observed short-term (1988-1996) rate shows an increase of 2.5 acres/yr in the growth of Grand Isle.

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DISCLAIMER

This poster is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards (and stratigraphic nomenclature). Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

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